



Application No.: 09/839,759
Amendment and Response dated: April 28, 2003
Reply to Office Action of: January 30, 2003
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A. Amendments to the Claims:

The below listing of claims will replace all prior versions and listings of claims in the subject application.

Claim 1. (Currently Amended) A process for recovering ethane from a hydrocarbon gas stream having methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 % by mole propane;

cooling the hydrocarbon gas stream by refrigeration to form a cooled and substantially condensed hydrocarbon feed gas stream, wherein said cooling of said hydrocarbon gas stream by refrigeration does not include turbo-expansion of said hydrocarbon gas stream;

separating the cooled and substantially condensed hydrocarbon feed gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

separating said ethane/propane-rich stream into an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

Claim 2. (Original) The process of claim 1 wherein said expanding of said methane-rich stream further includes:

turboexpanding said methane-rich stream.

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Claim 3. (Original) The process of claim 1 wherein said expanding of said methane-rich stream further includes:

compressing said methane-rich stream into a compressed methane-rich stream;

cooling said compressed methane-rich stream; and

turboexpanding the cooled and compressed methane-rich stream.

Claim 4. (Currently Amended) The process of claim 1 wherein separating said cooled and substantially condensed hydrocarbon ~~feed-gas~~ stream further includes:

distilling said cooled and substantially condensed hydrocarbon feed ~~gas~~ stream in a demethanizer column.

Claim 5. (Original) The process of claim 1 wherein separating said ethane/propane-rich stream further includes:

distilling said ethane/propane-rich stream in a de-ethanizer column.

Claim 6. (Canceled)

Claim 7. (Canceled)

Claim 8. (Original) The process of claim 1 wherein said ethane-rich stream contains at least 90 % by mole ethane.

Claim 9. (Original) The process of claim 1 wherein said ethane-rich stream contains at least 96.5 % by mole ethane.

Claim 10. (Original) The process of claim 9 wherein said ethane-rich stream contains less than about 0.5 % by mole methane and less than about 3% by mole propane.

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Claim 11. (Original) The process of claim 1 wherein said methane-rich stream contains at least 95% by mole methane.

Claim 12. (Currently Amended) A process for recovering ethane from a methane, ethane and propane containing gas stream comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 % by mole propane;

cooling the hydrocarbon gas stream to provide a vapor hydrocarbon feed stream and a condensed liquid hydrocarbon feed stream;

cooling the vapor hydrocarbon gas feed stream in a cryogenic heat exchanger by heat exchange with a first cooling source, a second cooling source and a third cooling source to form a cooled and substantially condensed hydrocarbon feed gas stream, wherein said first cooling is said condensed liquid hydrocarbon feed stream of said hydrocarbon gas stream does not include turbo expansion of said hydrocarbon gas stream;

distilling the cooled and substantially condensed hydrocarbon feed gas stream and the condensed liquid hydrocarbon feed stream in a demethanizer column to form a methane-rich stream and an ethane/propane-rich stream, wherein methane-rich stream is said second cooling source;

compressing said methane-rich stream to form a compressed methane-rich stream;

cooling said compressed methane-rich stream to form a compressed methane-rich stream;

turboexpanding said compressed methane-rich stream to a lower pressure to provide a said third cooling source for said cryogenic heat exchanger;

distilling said ethane/propane-rich stream in a de-ethanizer column to form an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

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Claim 13. (Original) The process of claim 12 wherein said ethane-rich stream contains at least 96.5 % by mole ethane.

Claim 14. (Currently Amended) A process for providing a methane-rich stream from a hydrocarbon stream containing methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 by mole propane;

()) cooling the hydrocarbon gas stream by refrigeration to form a cooled and substantially condensed hydrocarbon feed gas stream, ~~wherein said cooling of said hydrocarbon gas stream by refrigeration does not include turbo expansion of said hydrocarbon gas stream;~~

separating the cooled and substantially condensed hydrocarbon feed gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

recovering said methane-rich stream.

Claim 15. (Original) The process of claim 14 wherein said methane-rich stream contains at least 95 % by mole methane.